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APPLICATION FOR U.S. LETTERS PATENT

Title:

IC CONTACT UNIT AND IC CARD READER

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## IC CONTACT UNIT AND IC CARD READER

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from Japanese patent application number 305971/2000, filed October 5, 2000, the entire disclosure of which is incorporated herein by reference.

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0002] The present invention relates to an IC contact unit including a movable support provided with an IC contact point capable of coming in contact with a terminal of a magnetic IC card.

#### Description of the Related Art

[0003] Generally, an automatic transaction apparatus such as an automatic teller machine has a built-in IC card reader, and is structured such that customer data (fixed data) of an IC card is read by a magnetic head, and variable data such as transaction data is subjected to read/write processing by an IC contact unit.

[0004] Conventionally, in order to process the card data by bringing an IC contact point into contact with a terminal of the IC card, an IC contact unit has been used in which the IC card is transferred along a card transfer surface, the IC card is positioned and stopped at a predetermined position, a movable support provided with an IC contact point is moved by an actuator such as a solenoid, and the terminal at the side of the IC card and

the IC contact point at the side of the movable support are brought into contact with each other.

[0005] However, the foregoing IC card has a warp and a distortion, and in order to obtain excellent contact between the terminal and the contact point even if the IC card has the warp and distortion, a large solenoid is used in the conventional IC contact unit, and accordingly, there have been problems, namely that realization of miniaturization and compactness of an apparatus is difficult and consumed electric power required for driving the large solenoid becomes high.

#### SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide an IC contact unit by which an actuator such as a solenoid is miniaturized by using transfer force of an IC card, and the whole apparatus can be made compact and consumed electric power can be reduced.

[0007] Another object of the present invention is to provide an IC card reader including an IC contact unit in which a movable support can be driven by a small actuator.

[0008] An IC contact unit of the present invention is an IC contact unit including a movable support provided with an IC contact point capable of coming in contact with a terminal of an IC card and is constructed such that a guide portion for guiding the movable support is provided in a unit main body, a guide member to be inserted in the guide portion is provided at the movable support, a pawl member to be engaged with an end portion of the IC card is formed at the movable support, the pawl member is projected to a

card transfer surface by an actuator, and the movable support is moved by transfer force of the IC card.

[0009] The guide portion provided in the unit main body of the above structure can be formed by a guide groove or a guide hole.

[0010] The guide member at the side of the movable support of the above structure can be formed by a guide shaft or at guide pin.

[0011] The actuator of the above structure can be constructed by a solenoid or other actuators.

[0012] According to the above structure, the pawl member is projected to the card transfer surface through the movable support by the actuator, and when the end portion of the IC card comes in contact with the pawl member, the movable support is moved by the card transfer force.

[0013] In this way, since the movable support is moved by effectively using the transfer force of the IC card, the actuator may be small having a driving force of such a degree that the pawl member is projected to the card transfer surface, so that this actuator can be made small, and compactness of the whole apparatus and reduction of consumed electric power can be achieved.

[0014] According to an aspect of the present invention, urging means for retreating the pawl member from the card transfer surface at an ordinary time (a non-activated or rest

state) is provided, and the pawl member is projected to the card transfer surface through the movable support at a driving time of the actuator.

[0015] The urging means of the above structure can be formed of a mechanical urging member such as a coil spring.

[0016] According to the above structure, at the ordinary time (normal time), since the pawl member retreats from the card transfer surface, a projection timing of the pawl member by the actuator can be freely and arbitrarily set.

[0017] Since an IC card reader of the present invention includes the IC contact unit of the above structure, the movable support can be driven by a small actuator, and the degree of freedom in arrangement layout of the IC contact unit in the IC card reader is improved.

[0018] These and other advantages and features of the invention will be more readily understood from the following detailed description of the invention that is provided in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is an interior view of an IC card reader including an IC contact unit of the present invention.

[0020] FIG. 2 is a side view of the IC contact unit of FIG. 1 at an ordinary time.

[0021] FIG. 3 is a sectional view of the IC contact unit of FIG. 2 at the ordinary time.

[0022] FIG. 4 is an exploded perspective view of the IC contact unit of FIG. 2.

[0023] FIG. 5 is a side view of the IC contact unit of FIG. 2 at the time of projection of a pawl member.

[0024] FIG. 6 is a side view of the IC contact unit of FIG. 2 at the time of projection of the pawl member.

[0025] FIG. 7 is a side view of the IC contact unit of FIG. 2 at the time of contact of a contact point.

[0026] FIG. 8 is a section view of the IC contact unit of FIG. 2 at the time of contact of the contact point.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] An embodiment of the invention will be described below in detail with reference to the drawings.

[0028] The drawings show an IC card reader including an IC contact unit. In FIG. 1, an illustrated IC card reader 11 is constructed such that transfer rollers 14, 14, 15, 15, 16, 16 are provided at upper and lower opposite positions of a card transfer line 13 formed in a

card reader main body 12. An IC card A is reversibly transferred along the card transfer line 13 from an exit/inlet portion 17 of the IC card reader 11.

[0029] A press roller 18 and a transfer roller 19 are provided vertically to be opposite to each other between the transfer rollers 15 and 16, and a magnetic head unit 20 is provided at the side of the transfer roller 19, that is, at the lower side of the card transfer line 13.

[0030] The magnetic head unit 20 is constructed such that a magnetic head 21 is included, and reading of magnetic information such as customer data to a magnetic recording medium of the IC card A is executed by the magnetic head 21.

[0031] Further, an IC contact unit 22 is provided between the press roller 18 and the transfer roller 16 at the upper portion of the card transfer line 13. Variable data such as transaction data to an IC chip of the IC card A is subjected to read/write processing by the IC contact unit 22.

[0032] Although the IC card A includes a terminal connected with the IC chip, since its structure is well known, the illustration is omitted.

[0033] The IC contact unit 22 may be constructed as shown in FIGS. 2, 3 and 4. That is, as shown in an exploded perspective view of FIG. 4, the IC contact unit 22 includes a bracket 23 serving as a unit main body, a solenoid 24 serving as an actuator fixed to the bracket 23, an L-shaped arm 27 rotated and operated by a pin 26 attached to a plunger 25 of the solenoid 24, and a slider 30 serving as a movable support which is provided on its

lower surface with an IC contact point 28 (FIGS. 2 and 3) capable of coming in contact with a terminal of the IC card A. The slider 30 further includes a pair of pawl members 29 integrally or monolithically formed on a side of the slider and extending in a direction of the lower surface.

[0034] As illustrated, the bracket 23 includes a pair of side plates 32 and 33 for forming a slider arrangement space 31, a coupling plate 34 for mutually coupling both the side plates 32 and 33, a spring retainer 35 integrally and curvedly formed obliquely toward the front from an upper portion of the coupling plate 34, and a solenoid attachment plate 37 integrally provided to the side plate 33 through a spacer 36.

[0035] An attachment hole 38 used for attaching the IC contact unit 22 to the card reader main body 12 is formed in the attachment plate 37, and a hole portion 40 for disposing a support shaft 39 (see FIGS. 2 and 3) for support of the arm 27 is formed in a front end portion of the side plate 33.

[0036] A pair of guide holes 41 and 42 of the same general shape are each bored and formed in opposing relation in the respective side plates 32 and 33. The front side guide hole 41 (left guide hole of FIG. 4) is formed to include a horizontal portion 41a, a slant portion 41b, and a vertical portion 41c. The rear side guide hole 42 (right guide hole of FIG. 4) is formed to include a horizontal portion 42a and a slant portion 42b.



[0037] The L-shaped arm 27 serves as a depressing member for depressing the slider 30, wherein a vertical portion 27a and a horizontal portion 27b are integrally formed to be substantially L-shaped. A concave groove 43 (concave portion) loosely fitted to the pin 26 at the side of the plunger 25 is formed at an end portion of the vertical portion 27a. A hole portion 44, in which the support shaft 39 (FIGS. 2, 3) is fitted, is formed at a corner portion of the vertical portion 27a and the horizontal portion 27b.

[0038] Shafts 45 and 46 are attached to a base portion 30a of the slider 30 in parallel with each other through a plurality of receiving portions 30b. The front and rear shafts 45 and 46 correspond to the guide holes 41 and 42 at the sides 32, 33 of the bracket 23, and both end portions of the shafts 45 and 46 protruding outwardly from the receiving portions 30b become guide members movably inserted in the guide holes 41 and 42.

[0039] In FIG. 4, the respective components shown in the exploded perspective view are assembled as shown in FIGS. 2 and 3 and are arranged at a predetermined portion of the IC card reader 11. FIGS. 2 and 3 show the IC contact unit in a state of ordinary or normal time, which is a non-activated or rest state.

[0040] As shown in FIGS. 2 and 3, the front and rear shafts 45 and 46 at the side of the slider 30 are movably inserted in the corresponding guide holes 41 and 42. A coil spring 47 (return spring) is stretched between the center of the front side shaft 45 in the

longitudinal direction and the spring retainer 35 and serves as an urging means for retreating the pawl member 29 upwardly from the card transfer line 13 at the ordinary time.

[0041] The solenoid 24 moves the slider 30 downward, by retracting the plunger 25 which rotates the L-shaped arm 27, and projects the pawl member 29 of the slider 30 to the card transfer line 13. As shown in FIG. 1, when the end portion of the IC card A is engaged with the pawl member 29, the slider 30 is moved by effectively using the transfer force of the IC card A.

[0042] During the rest state shown in FIGS. 2 and 3, since the spring force of the coil spring 47 applies an upwardly directed bias to the slider 30, the front side shaft 45 is positioned at the upper end of the vertical portion 41c of the guide hole 41, and the rear side shaft 46 is positioned at the upper end of the slant portion 42b in the guide hole 42, so that a state is held where the pawl member 29 of the slider 30 retreats upward from the card transfer line 13, and the lower surface of the tip of the horizontal portion 27b of the L-shaped arm 27 is in contact with the upper surface of the receiving portion 30b at the side of the front side shaft 45.

[0043] An operation of the IC card reader constructed as illustrated is described below in detail. The IC contact unit 22 at the rest state is in a waiting state as shown in FIGS. 2 and 3. The pawl member 29 does not fall to the card transfer line 13 and it does not exert an influence on the transfer of the IC card A.

[0044] When the IC card A is inserted from the exit/inlet portion 17 of the IC card reader 11 (FIG. 1), the IC card A is pinched and transferred by the transfer rollers 14, 14, 15, 15. At a disposition portion of the magnetic head unit 20, the magnetic head 21 executes reading of magnetic information, such as, for example, customer data, from the magnetic recording medium of the IC card A.

[0045] When the solenoid 24 is driven at a predetermined timing while the IC card A is transferred in the transfer direction (direction from the right to the left in FIG. 1), the IC contact unit 22 is changed from the waiting state shown in FIGS. 2 and 3 to the state shown in FIGS. 5 and 6. Specifically, the plunger 25 is retracted by the solenoid 24, causing the L-shaped arm 27 to rotate in a slider depressing direction (a clockwise rotation of the L-shaped arm 27 causes a counter-clockwise rotation of the slider 30) about the support shaft 39.

[0046] The slider 30, although urged upwardly by the coil spring 47, is swung downwardly against the urging force, with the rear side shaft 46 positioned at the upper end of the slant portion 42b of the guide hole 42 and serving as a swing supporting, or pivot, point, and the pawl member 29 is projected to the card transfer line 13. At this time, the front side shaft 45 is displaced downwardly from the upper end of the vertical portion 41c of the guide hole 41 to the slant portion 41b as shown in FIGS. 5 and 6.

[0047] When the end portion of the IC card A is engaged with the pawl member 29 projected to the card transfer line 13 as shown in FIGS. 5 and 6, the slider 30 is moved in the card transfer direction against the urging force of the coil spring 47 by the transfer force of the IC card A, and the state shown in FIGS. 7 and 8 is obtained.

[0048] As shown, the front side shaft 45 at the side of the slider 30 is moved from the slant portion 41b of the guide hole 41 to the horizontal portion 41a, and the rear side shaft 46 is moved from the slant portion 42b of the guide hole 42 to the horizontal portion 42a, so that the IC contact point 28 of the lower surface of the slider 30 accurately comes in contact with the terminal provided in the IC card A.

[0049] Under the state shown in FIGS. 7 and 8, where the IC contact point 28 is in contact with the terminal of the IC card A, the IC contact unit 22 executes the read/write processing of variable data, such as transaction data, to the IC chip of the IC card A.

[0050] After completion of the read/write processing, when the IC card A is taken out and transferred (reverse transfer) toward the exit/inlet portion 17, the transfer force of the IC card A to the pawl member 29 disappears, thus returning the slider 30 from the contact state of the contact point and the terminal shown in FIGS. 7 and 8 to the waiting state

(original state) shown in FIGS. 2 and 3 by the urging force of the coil spring 47 (return spring) provided between the slider 30 and the spring retainer 35.

[0051] Since the front guide hole 41 has the vertical portion 41c extending upward from the rear end of the slant portion 41b, the front side shaft 45 is returned to the upper end of the vertical portion 41c. Further, the pawl member 29 of the slider 30 retreats upwardly from the card transfer line 13 as shown in FIGS. 2 and 3, and the pawl member 29 is housed again in the bracket 23 of the IC contact unit 22.

[0052] In this way, the IC contact unit 22 with the movable support (the slider 30) provided with the IC contact point 28 is capable of coming in contact with the terminal of the IC card A and is constructed such that the guide portion (the guide holes 41 and 42) for guiding the movable support swingably and movably in the front-back direction is provided in the unit main body (the bracket 23). The guide member (the shafts 45 and 46) to be inserted in the guide portion is provided at the movable support, the pawl member 29 to be engaged with the end portion of the IC card is formed at the movable support, the pawl member 29 is projected to the card transfer surface (the card transfer line 13) by the actuator (the solenoid 24), and the movable support is moved by the transfer force of the IC card A.

[0053] According to this structure, the pawl member 29 is projected to the card transfer surface by the actuator through the movable support. When the end portion of the IC

card A transferred on the card transfer surface comes in contact with the pawl member 29, the movable support is moved by the card transfer force.

[0054] Since the movable support is moved by effectively using the transfer force of the IC card A, the actuator used may be a small one having a driving force of such a degree that the pawl member 29 is projected to the card transfer surface, so that the actuator can be miniaturized, and the whole apparatus can be made compact and consumed electric power can be reduced. In addition, since positioning of the IC contact point 28 of the IC card A is carried out through the relation between the pawl member 29 and the guide portion, high positioning accuracy can be ensured.

[0055] The urging means (the coil spring 47) for retreating the pawl member 29 from the card transfer surface at the ordinary time (FIGS. 2 and 3) is provided, and the pawl member 29 is projected to the card transfer surface through the movable support at the time of driving of the actuator.

[0056] Consistent with the illustrated structure, at the ordinary time (rest state), since the pawl member 29 is retreated upward from the card transfer surface as shown in FIGS. 2 and 3, the projection timing of the pawl member 29 by the actuator can be freely and arbitrarily set.

[0057] Also, since the IC card reader 11 of the embodiment includes the IC contact unit 22, the movable support can be driven by the small actuator, and the degree of

freedom in arrangement layout of the IC contact unit 22 in the IC card reader 11 is improved.

[0058] Additionally, the four illustrated guide hole 41, 41, 42, 42 in total are formed in the bracket 23 as the unit, and when both the end portions of the two shafts 45 and 46 at the side of the slider 30 are movably inserted in the corresponding portions of the guide holes 41 and 42, the stable movement of the slider 30 can be ensured.

[0059] Further, when the urging means is stretched between the spring retainer 35 integrally formed on the bracket 23 and the shaft 45, it is not necessary to separately provide a spring receiving member, so that the number of parts and the number of assembling steps can be reduced.

[0060] In the correspondence between the structure of the present invention and the embodiment, the movable support of the prevent invention corresponds to the slider 30 of the embodiment, and similarly in the following, the unit main body corresponds to the bracket 23, the guide portion at the side of the unit main body corresponds to the guide holes 41 and 42 at the side of the bracket 23, the guide member at the side of the movable support corresponds to the shafts 45 and 46 at the side of the slider 30, the actuator corresponds to the solenoid 24, the card transfer surface corresponds to the card transfer line 13, and the urging means corresponds to the coil spring 47 (return spring).

[0061] According to the present invention, since the transfer force of the IC card is effectively used, the actuator, such as a solenoid, can be made small, the whole apparatus can be made compact, and the consumed electric power can be reduced.

[0062] While the invention has been described in detail in connection with exemplary embodiments known at the time, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

[0063] What is claimed as new and desired to be protected by Letters Patent of the United States is: